Trees

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Example tree
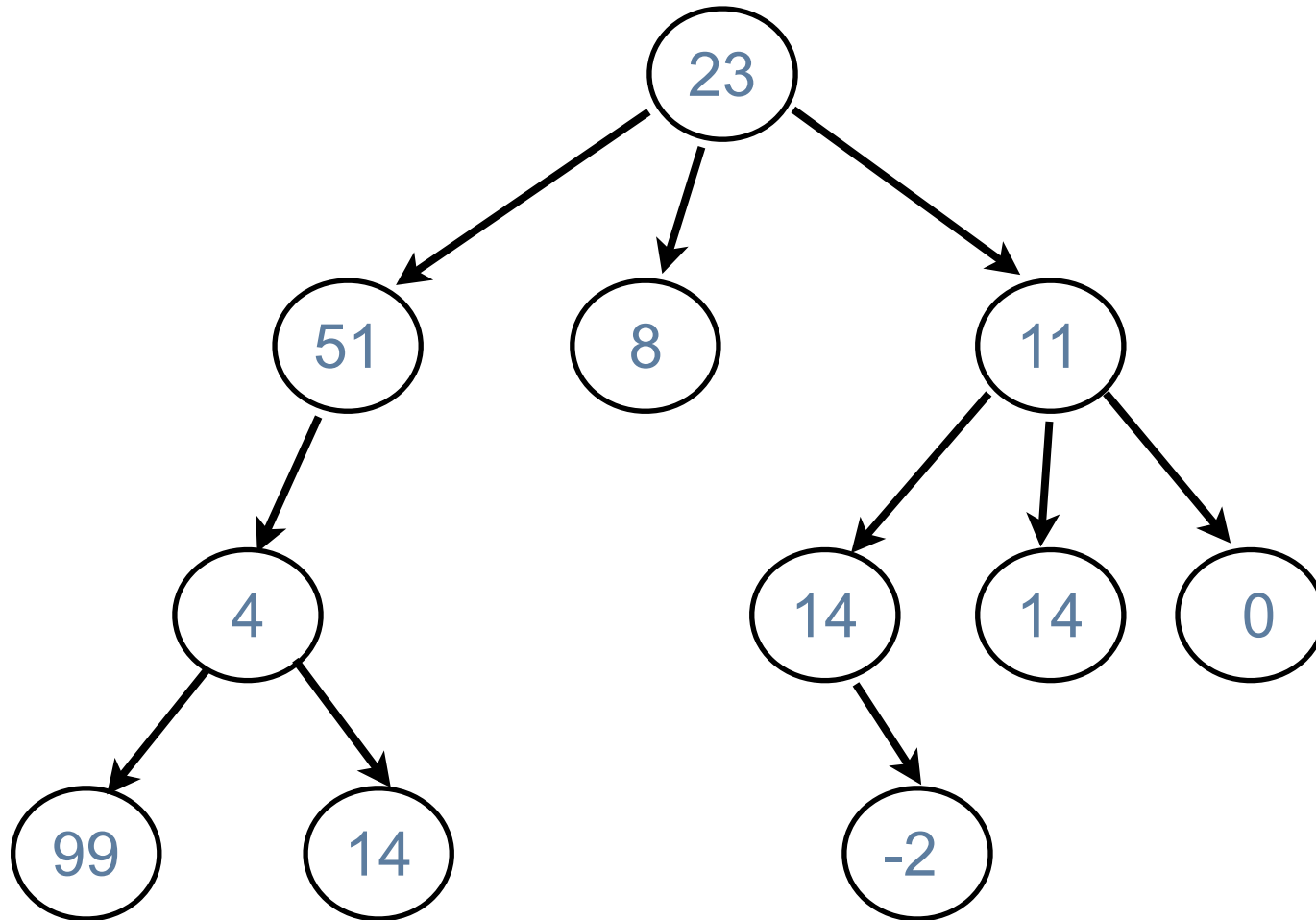
Terminology

- A tree is a set of nodes with directed edges between some pairs of nodes.

- An edge connects a parent node to a child node.

- Nodes may contain values.

- One node is distinguished as the root.

- Each node has exactly one parent, except the root.

Terminology

- A path is a sequence of nodes n1, n2, … nk where there is an edge from ni to ni+1.
- The length of a path is the number of edges on it.
- There is a exactly one path from a node to the root.
- There are no cycles (paths that form loops).

Terminology

- leaf: a node with no children.
- internal node: a node with one or more children.
- subtree: tree formed by any node and its descendants, and the edges connecting them.
- height of a tree: the maximum path length + 1.
- depth of a node: height of the whole tree minus the height of the tree rooted at that node.
- arity or branching factor: max # children for any node.

Uses for trees

- Trees can represent hierarchical relationships, such as:
    - the inheritance hierarchy in a program
    - relationships in an arithmetic expression, e.g.,
      (3 - (4 x (6 - 8)) + (25 / 2)
    - a directory structure